

Michigan Department of Transportation

Vehicle-Infrastructure Integration Strategic and Business Plan

Vision of
Partnership and
National Leadership

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Title

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Vision of Partnership and National Leadership

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Abstract

Michigan's Vehicle Infrastructure Integration (VII) Strategic and Business Plan provides the foundation for the Michigan Department of Transportation's (MDOT) VII efforts with wireless vehicle communication systems. It includes the mission, vision, and goals that address MDOT's intent to partner with key organizations and provides leadership, statewide and nationally, to research, develop and deploy VII.

This plan will initiate a course of action toward establishing the required public and private sector partnerships that will ensure leadership, innovation, and progress across the State of Michigan. The strategy focuses on partnering, developing and deploying a VII infrastructure and testbeds; increasing safety and mobility; improving asset management; developing outreach programs to better expose others to VII in Michigan; justify the need for VII; and determining creative investment funding venues for VII activities.

Table of Contents

Executive Summary	1
Introduction.....	6
MDOT Vehicle Infrastructure Integration Foundation.....	10
• MDOT's VII Mission Statement.....	10
• MDOT's VII Vision Statement	11
MDOT's Vehicle Infrastructure Integration Strategy	12
• Addressing the Needs of Customers and Partners.....	14
MDOT's Line-of-Business Strategy Diagram for VII	15
• Strategic Goals as Activity Fits	16
• Partnership Strategy.....	18
- Michigan Transportation Partnership (A1 in Figure 1)	19
- Michigan VII Working Group (A2 in Figure 1)	20
- Inter-State Partnership (A3 in Figure 1)	21
• Infostructure Deployment Strategy (<i>B in Figure 1</i>)	21
• Test Bed Strategy (<i>C in Figure 1</i>)	22
• Safety Strategy (<i>D in Figure 1</i>)	23
• Traffic Management Strategy (<i>E in Figure 1</i>).....	25
• Asset Management Strategy (<i>F in Figure 1</i>)	26
• Outreach Strategy (<i>G in Figure 1</i>).....	27
• Justification Strategy (<i>H in Figure 1</i>).....	28
• Investment Strategy (<i>I in Figure 1</i>)	28
Measures of Success.....	30
Glossary of Terms	31

Executive Summary

Michigan's Vehicle Infrastructure Integration (VII) Strategic and Business Plan provides the foundation for the Michigan Department of Transportation's (MDOT) VII efforts with wireless vehicle communication systems. It includes a mission and vision that addresses MDOT's intent to partner with key organizations and provide leadership, statewide and nationally, to research, develop and deploy VII.

This strategic plan was formulated under the guidance of MDOT's Director Kirk Steudle and with input from executives representing different divisions of state and local government to align with MDOT's organizational mission which is to "provide the highest quality integrated transportation services for economic benefit and improved quality of life" that address the needs of MDOT customers and partners through improved safety, traffic management, and asset management. The strategy describes MDOT activities that will address a broad set of customer/partner needs that include providing leadership in VII research and development, providing state-of-the-art VII test facilities and growing a sustainable VII deployment. The plan also describes the economic needs that will be met by pursuing financial support to provide a cost-effective integrated transportation system that will have positive economic benefits for the State of Michigan.

Traffic management requires more than just proper timing of signalized intersections and keeping roadways free of debris and obstructions. Traffic congestion continues to increase and traffic gridlock occurs in major cities around the world. The average motorist wastes nearly two days every year in traffic congestion. Furthermore, they take their lives in their hands every time they get behind the wheel.

Currently, 42,000 people die annually on our roadways nationwide. Traffic accidents are the leading cause of death for people between ages 4 and 33. Fifty percent of the deaths occur from intersection collisions and vehicles leaving the roadway. Annual traffic crashes cost the American economy \$230 billion, and traffic congestion cost \$63 billion while wasting 56 billion gallons of fuel.

VII offers a new approach to increasing the safety and mobility of our day-to-day travel. It will also increase the efficiency of our road systems providing real commercial and economic benefits. Wireless technology combined with GPS will enable vehicles to communicate with each other and with the roadways on which they are driven and to identify and avoid hazardous traffic situations and unexpected traffic delays. Wireless technology will help increase the efficiency of traffic management making our roadways safer to travel while decreasing congestion and the potential for traffic related incidents.

MDOT is actively involved in VII initiatives that will influence the safety of passengers in vehicles and how drivers make decisions based on information received from other vehicles and

the roadway. The intent is to establish wireless connectivity among vehicles and to the roadside infrastructure to help save lives, time, and money, spurring economic development. Imagine wireless communication systems combined with GPS alerting drivers to the dangers of vehicles passing in their blind spots. Imagine how much safer intersections will become when vehicle electronics alert drivers to traffic signal violations including their own due to possible distraction. With this type of technology, vehicles can serve as “probes” of deteriorating traffic and road conditions to assist the traffic management authority in responding more effectively to traffic incidents and needed road repairs. Furthermore, VII will reduce the labor and cost associated with the management of traffic and the management of transportation assets. This is a win-win proposition all the way around. MDOT and its partners (Michigan State Police, Michigan Economic Development Corporation, Michigan Department of Information Technology, and Road Commissions for Macomb and Oakland Counties) have developed a five-year VII strategy to ensure the appropriate infrastructure to support VII is built in Michigan.

MDOT’s VII Strategic and Business Plan captures the vision, mission, needs, goals, activities and measures of success that will guide a coordinated, efficient, safe, and integrated vehicle-infrastructure system throughout the state. The strategic plan will initiate a course of action toward establishing the required public and private sector partnerships that will ensure leadership, innovation, and progress across the state of Michigan. Roads will need the appropriate and standardized communication infrastructure. Vehicles will need compatible transceivers and processors to make this all work. The strategy focuses on partnering, developing and deploying a VII infrastructure and testbeds; increasing safety and mobility; improving asset management; developing outreach programs to better expose others to VII in Michigan; justify the need for VII; and determining creative investment funding venues for VII activities. This strategy is reflected in MDOT’s VII Mission.

MDOT’s VII Mission

MDOT’s VII Mission is to partner with public agencies, the automotive industry, and the telecommunications industry to lead the nation in VII research and sustained VII deployment by providing the public foundation for Michigan’s new automotive information technology industry and ensuring improvements in transportation systems safety and operational performance.

Customers and Partners

MDOT cannot do this alone. It will require initiating partnerships and nurturing relationships with some familiar colleagues in public agencies and some less familiar new acquaintances in the automotive and telecommunications industries. Some of MDOT’s potential customers and partners include:

- Motorists
- Commercial fleets
- Local agencies (local and regional transportation agencies)

- USDOT
- Automotive OEMs
- Automotive suppliers (including telematics)
- Universities
- Other states

MDOT's VII Vision

Together with their customers and partners, MDOT will work toward their common vision of leading the nation in the development and implementation of VII. Elements of this shared vision include:

- The Michigan partnership is a recognized leader of and key reason for the success of VII.
- Michigan is partnering with the automotive industry, including OEMs and suppliers, and the telecommunications industry, and has demonstrated success in researching, developing, and deploying VII.
- Michigan is partnering with other states to assure coordinated research, development and deployment across the United States.
- VII test results provide clear measurable evidence that VII increases transportation safety, mobility, and security.
- VII has been accepted enough to be programmed into the annual budgeting of Michigan's transportation needs.
- VII has become an emerging industry with an entrepreneurial foundation that is central to Michigan's strong new information technology sector.
- VII is becoming acknowledged as the biggest change in passenger and commercial transportation since the inception of the Interstate Highway System.

This is a tall order, and the Michigan team is determined and particularly well-situated to make this happen.

Strategic Goals as Activity Fits

Several strategic goals will help set MDOT's sights on taking the right actions to attain this vision in partnership with the Michigan team. These goals can be viewed as "activity fits," defined as a group of activities that "fit together" or are aligned to achieve a desired outcome or goals like building strong partnerships and deploying the appropriate infrastructure for leading the national deployment of VII. These groups of activities also assure that MDOT's desired goals are supported to meet the needs of our customers and partners. To provide feedback on performance, goals will be measurable and changes implemented to continually improve strategic alignment and support. The following are MDOT's strategic goals for the VII line-of-business:

- **Partnership:** Partner with OEMs and other stakeholders essential to developing and delivering a national VII.
- **Infostructure:** Lead the nation in the design, testing, and deployment of an effective standard VII infostructure.
- **Test Bed:** Design, implement, maintain, and promote Michigan VII test and development facilities.
- **Safety:** Support Michigan-based VII safety system research, development, and early deployment.
- **Traffic Management:** Support Michigan-based VII traffic management system research, development, and early deployment.
- **Asset Management:** Support Michigan-based VII asset management system research, development, and early deployment.
- **Outreach:** Maintain high visibility of Michigan activities through outreach and public awareness.
- **Justification:** Justify planned deployment through analysis and research providing evidence of value-added results.
- **Investment:** Coordinate and leverage Michigan investment to attract public, private, national, and international support.

This MDOT VII Strategic and Business Plan will require consistent maintenance and updates to keep up with dynamic changes taking place in the field of VII partnerships, research, planning, design, testing, development, deployment, and technology. The activities that support the above goals will be pursued by MDOT in the VII line-of-business and measured to provide continuous feedback for process and activity improvement. A critical initial activity is to encourage review and obtain input of the overall plan from key representatives of the customers and partners cited above. This is an urgent strategic activity that MDOT is already engaged in.

The specific strategic and tactical measures of success referenced to each of the activities are listed on page 30. These will also be refined and updated as the continuous planning process proceeds. Success at the activity level will ensure that the strategy is implemented and that the goals are achieved.

MDOT's Line-of-Business strategy for VII is succinctly summarized graphically in Figure 1. The schematic provides a visual representation of strategic elements and interrelationships including the customers/partners and their needs, goals, and activities, as well as measures that will be taken in the next five years to achieve the VII mission and vision. Furthermore, the strategic plan shows the alignment and support between goals and needs that stand on a strong foundation of activities necessary to develop lasting partnerships. Increased safety, more efficient mobility, and economic development are the chief end products for MDOT's pursuit of VII.

To ensure this plan is truly a working document; activities will be pursued and measured continuously. Some of the activities include, but are not limited to, developing and forming

relationships and partnerships with OEMs, developing a Michigan VII working group, partnering with other states, and the USDOT. Other activities include designing, testing, and deploying a wireless infrastructure, designing a self-supporting testbed, active collision avoidance systems for safety, en route accident/construction/event alerts for Traffic Management, and infrastructure deterioration data collection for Asset Management. For a complete list of Michigan VII activities, see pages 19 through 29.

The process of preparing the plan involved a careful review of Michigan's strengths, weaknesses, and opportunities in the context of the VII test and deployment ecosystem. The background material for the plan is summarized in a separate document titled MDOT's VII History and Background. This document provides a more detailed look at how Michigan will lead the nation in VII and the advantages Michigan has because of the close proximity to the automotive manufacturers, telecommunication suppliers and technological resources that are well established here in Michigan.

Introduction

The VII Strategic and Business Plan was organized and developed by MDOT with support from the Michigan State Police (MSP), the Michigan Economic Development Corporation (MEDC), the Michigan Department of Information Technology (DIT), and the Road Commissions for Macomb and Oakland Counties.

MDOT led the VII strategic and business planning process through six planning phases. Phase one involved general preparation and organization; the general purpose was to ensure that MDOT is ready, and that the appropriate resources and people were committed, creating momentum to get a successful process started. This phase created the steps for the process, getting the participants involved, preparing the organizational profile leading to a VII plan. A kickoff meeting was held for the planning group to review the history of the VII efforts and articulate a draft mission.

Phase two defined the strategic and business planning issues, including assessment of MDOT's current VII position, allowing us to gain a better understanding of the business landscape in which MDOT operates and where VII will unfold. This revealed strategic opportunities for VII in Michigan, and helped identify strategic initiatives to address the opportunities. A meeting was held that had participants contribute to an environmental scan of VII and an internal analysis that included strengths, weaknesses, opportunities, resources and core competencies.

Phases three and four involved crafting the plan and included determining MDOT's top VII priorities, and considering how resources would be allocated toward those priorities. The planning team also created the first draft of the action plan. Phase five involved writing and editing the plan. Phase six is ongoing and monitors the success of implementing the strategies.

The plan takes into account that Michigan is the hub of the automotive industry in the United States. Automotive research, design, and engineering are centered in the state. The large number of automotive test and fleet vehicles that could potentially be used to prove the VII concept is also unique to Michigan.

VII can be described as a systems approach to road transportation that relies on wireless communication technology to communicate between vehicles and between vehicles and the roadside. Innovation in mobile communications linking vehicles and highways will help make our lives easier and our driving safer. In the future, vehicles will communicate with traffic signals, making intersections safer. Vehicles will also communicate with each other and warn drivers of unsafe conditions. Traffic managers will receive wireless messages from moving cars and trucks serving as traffic probes, detecting traffic problems like congestion and potholes as they emerge.

Safety is one of the greatest concerns of motorists – for good reason. In the United States, road transportation poses a greater risk to life and health than does gun violence or common diseases

like flu and pneumonia. In fact, over 2.6 million rear-end, run-off-the-road, and lane-change accidents occur every year in the United States. The United States Department of Transportation (USDOT) has estimated that active safety systems and similar countermeasures could prevent nearly half of those crashes, saving thousands of lives. Information systems will play a critical role in improving safety by making it possible to warn drivers of dangerous traffic conditions (approaching emergency vehicles, dangerous curves, hazardous road conditions, etc.) as well as helping traffic agencies and emergency services respond more quickly to life threatening situations.

Mobility that was made possible by the completion of the US national highway system is now threatened by congestion caused by urban sprawl and Americans' mobile lifestyles. Motorists want to get to their destinations quickly and without delay. This shifts the focus of road transportation services from supporting basic travel to promoting more efficient transportation. Information systems can help here by detecting incidents more quickly and informing drivers of impending delays or alternate routing. The information can also help the road authority respond more efficiently to problems that cause delays on the roadways.

MDOT is working with automotive, telecommunications, and consumer electronics companies to research, develop and deploy a wireless infrastructure on Michigan roads. This investment will enable vehicles to communicate with the roadside and exchange messages in real time to improve vehicle safety and to provide transportation services inside the vehicle and to our traffic management centers.

Vehicles that are outfitted with wireless broadband technology will have the ability to communicate with the roadside and receive real time messages about emerging conditions while approaching unsafe intersections, traffic incidents, road construction and maintenance sites. Drivers will be able to make appropriate maneuvers to increase their safety and that of the vehicles around them. Vehicles will also be able to communicate with each other and send warnings to help coordinate maneuvers and increase safety.

Similarly, traffic management operators will receive real time wireless messages from vehicles and be able to monitor traffic conditions and respond immediately to or even in anticipation of traffic events. This will improve management of traffic around incidents and will help prevent incidents from occurring in the first place by providing drivers with in-vehicle safety and communication systems. An added feature for MDOT and other transportation agencies is that this technology will allow vehicles to serve as "probes" on the roadway sending back continuous information on pavement, weather, and other location specific conditions along the road network. These systems will save MDOT and other transportation agencies time and expense while helping manage the public road infrastructure assets more effectively.

Communication technologies are now more versatile and cost-effective than at any time in the past – enabling the design of new digital highways that will help us enjoy greater mobility and safety along our highways. The future of VII provides Michigan an opportunity to take the lead

in supporting a new high growth industry that combines existing advanced automotive design and engineering resources along new telecommunications and consumer electronics products to provide the most integrated and technologically advanced transportation system in the world.

To accomplish this, MDOT will partner with other equally committed parties (public agencies, automotive manufacturers and suppliers, telecommunications and consumer electronics companies), to lead the nation in VII research, development and sustained VII deployment. This partnership is the core of a broad strategy that will place Michigan at the center of automotive wireless developments.

Michigan is the international center for automotive engineering and design, this sets it apart from other regions of the United States as the place to incubate and grow this new industry. Michigan has the people, technology and commitment to make this happen. These local resources provide the foundation for rapid testing and development of new technologies enabling Michigan businesses to compete in the emerging connected vehicle market. Michigan employs one out of every four automotive workers in the United States. Michigan is home to more than 186,000 skilled trades workers. No other state can offer the concentration of automotive engineers that are familiar with the requirements of in-vehicle safety and communications systems. No other state can offer the concentration of Original Equipment Manufacturers (OEM) and suppliers that will take responsibility for setting standards, designing, and deploying these systems. Michigan is the hub of the North American automotive industry.

The time has come for state and federal transportation departments to cooperate with automotive manufacturers and suppliers to test the value of nationwide deployment of wireless vehicle-to-vehicle and vehicle-to-roadside communications that will increase motorist mobility and safety while enabling new services that will provide commercial benefits.

MDOT is committed to taking a leadership role is collaborating with the automotive Vehicle Infrastructure Integration Consortium (VII-C), Crash Avoidance Metric Partnership (CAMP), Integrated Vehicle Based Safety System (IVBSS) program, and the Connected Vehicle Trade Association (CVTA) all of which are centered in Michigan. MDOT is one of the original members of the USDOT's National VII Working Group. During the last two years MDOT has been working to establish a connected vehicle test bed in cooperation with GM, Ford, DCX, and Nissan. These test areas are currently up and running.

An essential component of the strategy described in this plan is the creation of an executive level partnership between the State of Michigan and its automotive OEMs. Such a partnership could potentially include DaimlerChrysler, Ford, General Motors, Hyundai, Nissan, Toyota and others. These manufacturers are a major presence in the state of Michigan and are equally committed to the mission of advancing VII in Michigan and throughout the nation. This partnership would provide a high level strategic approach to addressing new opportunities for transportation innovation and economic development in the State of Michigan.

MDOT's mission is to provide the highest quality integrated transportation services for economic benefit and improved quality of life. With regard to technology, the MDOT Intelligent Transportation Systems (ITS) mission is to develop and sustain a program at MDOT to improve transportation systems safety and operational performance using existing and innovative Intelligent Transportation Systems technologies for economic benefit and improved quality of life. The vision is MDOT as a public leader and a supporting partner in the research, development, deployment, operation, and maintenance of ITS. Part of this vision is for MDOT to be recognized nationally for VII research and deployment. The VII Strategic and Business Plan provides the strategy and activities to accomplish these goals.

MDOT Vehicle Infrastructure Integration Foundation

MDOT's mission and vision for VII provides the foundation for the VII strategy and business plan. The plan elaborates on MDOT's ITS strategy, mission, and vision, while supporting the goals of MDOT's overall organizational strategy. The VII mission statement expresses the overall, long-range intention for Michigan's VII program. A statement of the mission often includes the purpose of the initiative; the "business" an organization engages in to achieve this purpose, and a statement of the values guiding the accomplishment of the mission. The VII vision is a guiding image of success formed in terms of an overall contribution to society. If a strategic plan is the "blueprint" for an organization's work, then the vision is the "artist's rendering" of the achievement of that plan. It is a description that conjures up a similar picture for each member of the group of the destination of the group's work together.

MDOT's VII Mission Statement

MDOT's Mission is to:

Provide the highest quality integrated transportation services for economic benefit and improved quality of life.

The specific needs and issues addressed by ITS are summarized in the ITS mission statement.

MDOT's ITS Mission is:

Develop and sustain a program at MDOT to improve transportation system safety and operational performance using existing and innovative Intelligent Transportation Systems technologies for economic benefit and improved quality of life.

MDOT's VII Mission is to:

Partner with public agencies, the automotive industry, and the telecommunications industry to lead the nation in VII research and sustained VII deployment by providing the public foundation for Michigan's new automotive information technology industry and ensuring improvements in transportation systems safety and operational performance.

The intent is to establish wireless connectivity among vehicles and to the roadside infrastructure to help save lives, time, and money, spurring economic development. This supports the American Association of State Highway and Transportation Officials (AASHTO) VII Policy Statement which supports the continued study, testing and deployment of VII applications and systems aimed at accomplishing the following goals: (AASHTO, 2005)

- Save Lives: Achievement of AASHTO's goal of reducing national highway crash rates to 1.0 fatality per 100 million vehicle miles traveled.

- **Save Time:** Reduce congestion and delays. Enhance the ability to make informed travel choices. Improve the ability of transportation managers to quickly respond to and clear incidents and non-recurring events.
- **Save Money:** Diminish lost productivity due to congestion and delays. Enable more timely goods movement, improved commerce and trade, and more efficient border crossings. Improve fuel efficiency and reduce cost of travel.
- **Spur Economic Development and Create Jobs:** Support initiatives through co-development and co-deployment opportunities. Seek creation of local industries to provide VII products and services.

MDOT's VII Vision Statement

There is one universal rule of planning: You will never be greater than the vision that guides you. No Olympic athlete ever got to the Olympics by mistake; a compelling vision of his or her stellar performance inevitably guides all the sweat and tears for many years. The vision statement should require the organization's members to stretch their expectations, aspirations, and performance. Without that powerful, attractive, valuable vision, why bother?

MDOT's Vision for ITS clarifies the broader vision for MDOT and emphasizes partnership and leadership. In this vision MDOT is a public leader and supporting partner in the research, development, deployment, operation, and maintenance of ITS. MDOT's ITS vision is:

- Focused on customers, adding measurable value to their daily lives with an emphasis on commerce and economic growth.
- Engaged in effective partnerships for the promotion and integration of ITS.
- Recognized nationally for VII and Intelligent Vehicle Initiative (IVI) research and deployment.
- Statewide, coordinated, integrated and seamless.
- Integrated fully into MDOT's business processes.
- Supported by dedicated long-term funding and managed in a sustainable manner.

Given MDOT's vision and MDOT's ITS vision the vision for VII is:

- *The Michigan partnership is a recognized leader of and key reason for the success of VII.*
- *Michigan is partnering with the automotive industry, including OEMs and suppliers, and the telecommunications industry, and has demonstrated success in researching, developing, and deploying VII.*
- *Michigan is partnering with other states to assure coordinated research, development and deployment across the United States.*
- *VII test results provide clear measurable evidence that VII increases transportation safety, mobility, and security.*

- *VII has been accepted enough to be programmed into the annual budgeting of Michigan's transportation needs.*
- *VII has become an emerging industry with an entrepreneurial foundation that is central to Michigan's strong new information technology sector.*
- *VII is becoming acknowledged as the biggest change in passenger and commercial transportation since the inception of the Interstate Highway System.*

MDOT's Vehicle Infrastructure Integration Strategy

The VII strategy describes the goals, objectives, and activities that will be accomplished in the next five years to accomplish the VII mission and pursue the VII vision. Fewer crashes, less severe crash injuries, and more efficient travel are the targets for deploying the new communication technologies connecting the vehicles to the infostructure/infrastructure. Increased safety and more efficient mobility are the chief end products for MDOT's pursuit of VII.

While this is not the place to elaborate on the economic difficulties that Michigan is facing, it is not an exaggeration to say that the Michigan automotive industry is in crisis and that retaining and attracting jobs is at the forefront of the Governor's agenda. Michigan currently has more than 200,000 jobs tied to the auto industry. MDOT's VII activities have a potentially important role to play in the conception of new products and services that will create and attract new jobs to Michigan. This will appeal to the:

- Automotive companies whose vehicles the VII devices will be attached to.
- Consumer electronics companies that will design and manufacture the electronic devices that drivers will use.
- Telecommunications companies that will design and supply the in-vehicle communications and roadside infostructure that the vehicles will communicate with.
- Automotive supply companies who will design and manufacture the telematics capabilities that will be integrated into the vehicles.
- Software companies that will adapt, develop, and manufacture new operating systems and applications that will operate in the vehicle and across the Internet and other wireless environments.
- Independent service providers who will eventually support the safety and probe data services that VII will provide to customers.

The general strategy is to create and attract new information technology (IT) jobs to Michigan by leveraging the unique automotive design and engineering resources already located in Michigan and expanding the IT jobs that will benefit from collaborating with an existing technology resource base. New jobs will come from the design of new products and services that take advantage of the new Vehicle Infrastructure Integration system. New jobs will be created by the field testing of new VII products and services. This is the engineering core of the new mobile device industry. New jobs will be attracted to the engineering and design core with the

expansion into consumer electronics and wireless communications. The intent is to make Michigan the birthplace and rightful home of an emerging industry in telematics and wireless mobile communication linked to the automobile.

The VII Program in Michigan impacts the lives of Michigan citizens beyond transportation and will have economic development impacts:

- New information technology industries form in Michigan as a result of the VII development effort and are implemented as a result of coordinated efforts with State of Michigan Economic Development Partners.
- Improved mobility for automaker related activities through coordination between MDOT and the automakers on VII and other transportation related issues.
- Improvements in safety, security and traffic flow provide a positive impact on quality of life, encourage private sector investment in Michigan, and improve tourism

In order to accomplish these things, MDOT must pursue this opportunity using a process that involves extensive collaboration and partnership with organizations not traditionally involved in the infrastructure design process, including automotive companies with vehicles that will communicate with the system and with telecommunications and consumer electronics companies with devices and technologies that support electronic communication. The VII strategy will focus on describing what needs to be achieved and how to accomplish these goals over the course of the next five years.

In order to accomplish the goals of improving safety, mobility, and asset management (VII Use Cases), it is essential that the investment made in proof of concept and field operational testing results in products and services that benefit MDOT and their customers be done in a manner that is independent of what is learned through design or testing. That is, although much of the near term activities will focus on design and testing, something of unquestionable value should emerge from this effort and lead to the development and deployment of systems that will improve driver safety and mobility in the State of Michigan. Therefore, a key to accomplishing the goals is to ensure that the investment in VII is sustainable and that the deployment plan is technically and financially feasible. Furthermore, it will be critical to ensure information security and exchange of data will support acceptable standards of user privacy.

Finally, this level of collaboration among public and private sector partners will eventually require the formalization of new relationships and the establishment of new models for doing business. Public agencies like MDOT will find ways to exchange its resources (i.e., roadside right-of-way) for private resources (i.e., data collected by probe vehicles), and use this exchange to deliver safety, mobility, and consumer services while formulating a way to develop new opportunities for both the public and private sectors.

Addressing the Needs of Customers and Partners

MDOT's line-of-business strategy diagram for VII is summarized in Figure 1. The diagram presents the strategy on a single page in a format that highlights customer needs, displays internal measurable goals, lists all relevant strategic activities, suggests synergies that leverage MDOT's strengths, and helps readers understand the alignment between management activities and the line-of-business goals. Finally, the diagram shows how each goal supports the needs of the customers and partners. This diagram is the focal point for understanding how MDOT will create alignment between the VII line-of-business strategy and MDOT's overall organizational 2006 Strategic Plan.

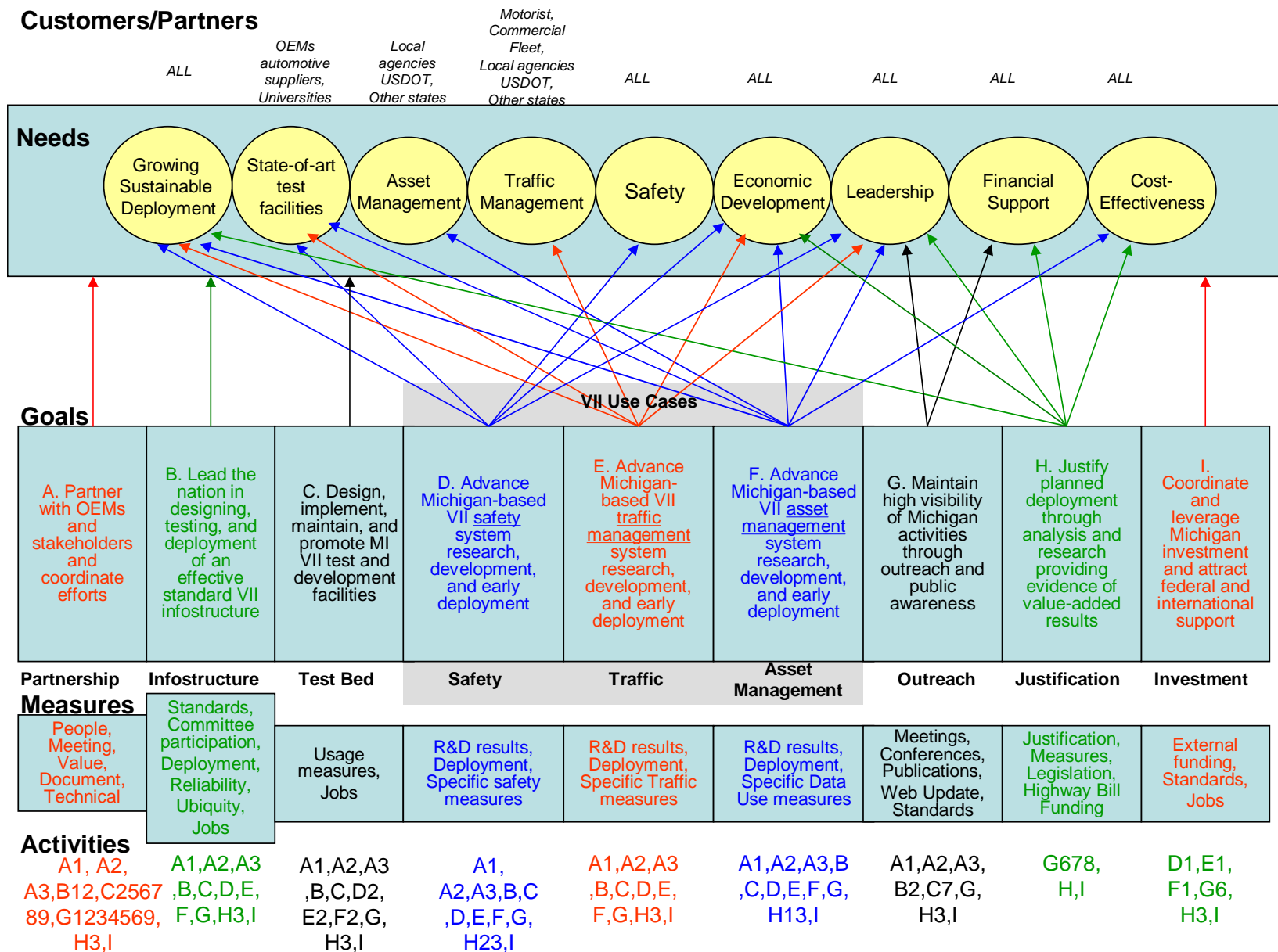
The customers and partners are the primary drivers of MDOT's VII strategy. The customer's long-term use of the products and services supported by MDOT and MDOT's partners will determine the viability and sustainability of VII and the ultimate success of this strategy.

MDOT has a wide range of potential customers and partners for VII. The term customer is meant to imply that MDOT provides products and services to users of the transportation system and that the system has economic and mobility benefits beyond the everyday commuter and other drivers that use the system. In this context, the concept of customer is any individual or organization that will use, benefit from, and/or pay taxes for Michigan's VII. Similarly, the delivery of VII products and services will require partnering with many of MDOT's customers and benefit stakeholders, many of whom will gain by designing and offering products and services that the new market in VII will support. Some of MDOT's potential customers and partners include:

- Motorists
- Commercial fleets
- Local agencies (local and regional transportation agencies)
- USDOT
- Automotive OEMs
- Automotive suppliers (including telematics)
- Universities; and
- Other states

MDOT's Line-of-Business Strategy Diagram for VII

Figure 1.



MDOT's customers and partners for VII also have needs that must be addressed in the VII strategy if it is to be successful. It is MDOT's role to deliver on the products and services that support these needs in the most competitive and cost effective manner. The customer and partner needs in the VII strategy are:

- **Growing Sustainable Deployment:** Research and testing of VII is just a start. The intent is to initiate and sustain the deployment of a standard ubiquitous national VII infostructure along with evidence providing justification and political support for state and national VII deployment.
- **State-of-the-art Test Facilities:** State of the art VII test and development facilities and competencies is core to advancing VII especially from the perspectives of the OEMs, automotive suppliers, telematics providers, and Michigan universities.
- **Asset Management:** Data and analysis of Michigan's transportation assets and infostructure are required if transportation assets are to be managed effectively.
- **Traffic Management:** Well managed traffic and efficient travel with minimum congestion and delay is needed by the motorists, commercial fleet, local transportation agencies and the USDOT to name a few.
- **Safety:** Safer travel along Michigan roads includes reducing the number and severity of vehicle crashes, related property damage and productivity losses, and related delay by increasing the overall safety of equipped vehicles.
- **Economic Development:** Growth in VII-related jobs and a strong Michigan economy is a core need for all customers and partners. The economic development goal for VII is for MDOT to facilitate collaboration and to work with all the parties that will be involved in the design and deployment of VII in Michigan and contribute to the emergence of a new industry that will create and attract new jobs to the state.
- **Leadership:** National leadership and coordination for advancing VII quality, performance, and national deployment is a unique role that Michigan can play.
- **Financial Support:** Financial support for advancing research and development in VII (preferably supplemental to Michigan's tax base) is essential, given the need to advance the state of the art and practice in wireless technology for vehicle infrastructure integration.
- **Cost-effectiveness:** Provide effective infrastructure, infostructure, products, and services at the lowest cost.

Strategic Goals as Activity Fits

MDOT's strategic intent is to meet these needs and be the leader in the development and implementation of wireless technology for vehicle infrastructure integration to improve safety, mobility, economic development, and asset management while securing and sustaining partnerships that leverage resources to support the mission for economic benefit and improved quality of life. This will be accomplished through a single line of business that addresses the

needs of partners and customers through the support of wireless transportation innovation and technology linking vehicles to the infrastructure and other vehicles.

Several strategic goals will help set MDOT's sights on taking the right actions to meet the needs of MDOT's customers and partners. These goals can be viewed as "activity fits", defined as a group of activities that "fit together" or are aligned to achieve a desired outcome or goal. These groups of activities will assure that MDOT's desired goals are supported to meet the needs of our customers and partners. To provide feedback on performance, goals will be measurable and changes implemented to continually improve strategic alignment and support. The following are MDOT's strategic goals for the VII line-of-business:

- **Partnership:** Partner with OEMs and other stakeholders that are essential to developing and delivering a national VII
- **Infostructure:** Lead the nation in the design, testing, and deployment of an effective standard VII infostructure
- **Test Bed:** Design, implement, maintain, and promote Michigan VII test and development facilities
- **Safety:** Support Michigan-based VII safety system research, development, and early deployment; to reduce crashes and delay while increasing the safety of equipped vehicles
- **Traffic Management:** Support Michigan-based VII traffic management system research, development, and early deployment; to reduce delay and relieve congestion. VII will help improve the traffic operations and infrastructure investment by helping to collect better planning data and providing better information that will help manage throughput and capacity.
- **Asset Management:** Support Michigan-based VII asset management system research, development, and early deployment; to improve cost-effective investment in Michigan's transportation infrastructure and the VII infostructure. Part of this strategy includes collecting vehicle probe data and thereby reducing the cost of data collection for delivering planning and asset management services.
- **Outreach:** Maintain high visibility of Michigan activities through outreach and public awareness; coordinate and share information with stakeholders and other states to increase the rate and success of the national VII deployment.
- **Justification:** Justify planned deployment through analysis and research providing evidence of value-added results; produce research, test results, and analysis that provide the justification for Michigan and national VII deployment.
- **Investment:** Coordinate and leverage Michigan investment to attract public, private, national, and international support; attract national and international investment in VII testing, products, and services.

The activities that will be pursued by MDOT in the VII line-of-business will be measured. The specific strategic and tactical measures referenced to each of the activities that follow are listed

on page 30. Success at the activity level will ensure that the strategy is implemented and that the goals are achieved.

Partnership Strategy

MDOT's goal includes partnering with organizations from the automotive, telecommunications, and consumer electronics industries, and coordinating with other public agencies, and working together with these partners in the design, testing, deployment, and long-term maintenance and support of the VII system.

Representatives of the automotive industry, telecommunications industry, and public transportation agencies will contribute to the design and deployment of VII to reflect an integrated transportation system perspective of vehicle and infrastructure design. Given the complimentary roles in support of transportation by the public and private sectors, addressing these higher order effects requires cooperation and action from both sectors. Only by working in partnership can they address the environmental, health, and safety impacts of the transportation system; ensure that the transportation network remains conducive for economic development; and assure that mobility improvements are sustainable in the future. Both sectors will benefit from sustainable mobility that supports the movement of people and goods in a safe and environmentally sound manner.

From the perspective of the automotive industry it is essential for all states to participate and to ensure that the communications infrastructure and traffic information will be provided consistently across the United States; from the perspective of the 50 states it is essential for all the auto companies and the entire automotive industry to participate and ensure that all in-vehicle traffic information systems will comply with a standard delivery approach adopted by the states.

For the telematics industry, this initiative may provide the needed impetus to rally the industry to a single expert test environment for a more focused telematics systems development, services development, and field operational testing. This initiative will significantly accelerate the roll out of VII products and services that will increase the U.S. telematics market and serve as the standard for nationwide system deployment.

In order to manage VII from a full systems perspective, MDOT will need to collaborate with a broad range of organizations that will contribute to the design, testing, deployment, and long term maintenance of the integrated system. MDOT will need to develop and maintain new relationships with companies from the automotive industry (including the OEMs and automotive suppliers) who will be responsible for developing in-vehicle systems. MDOT will also need to pursue new relationships with companies in the telecommunications and consumer electronics industry that will be responsible for developing mobile devices and communications technologies. Finally, MDOT will need to coordinate and partner with departments within the state and public agencies that will be responsible for other portions of the system, including traffic signals on local surface streets and emergency and maintenance operations.

The VII Program in Michigan will successfully engage multiple partners with long-term, mutually beneficial objectives:

- New dialog opens between MDOT and the automakers on multiple issues (not just VII)
- The telecommunications industry actively participates in transportation activities
- Multiple states work together in the development and testing of VII to ensure that systems function in all conditions and geographic locations

The following activities comprise partnership strategies that support the public and private collaborative goals for VII described in this section including partnerships and public outreach:¹

Michigan Transportation Partnership (A1 in Figure 1)²

At the forefront of the MDOT VII strategy is the creation of an executive level partnership between the State of Michigan and its automotive OEMs. Such a partnership could potentially include DaimlerChrysler, Ford, General Motors, Hyundai, Nissan, and Toyota. All have a major presence in the state. The purpose of this partnership will be to provide a high level strategic approach to addressing new opportunities for transportation innovation and economic development in the State of Michigan. The MDOT VII strategic goal for partnership is to partner and coordinate efforts with OEM's and stakeholders.

The creation of this partnership alone is significant. In no other venue does senior management in the State of Michigan meet with all of the State's automotive OEMs to discuss the opportunities for transportation innovation and economic development.

Fundamentally, it is essential that the automotive industry remain a viable industrial cluster in the State of Michigan. This strategic alliance will focus on technology-based innovation and support for new OEM business models that advance VII technologies into the marketplace more cost effectively and expeditiously.

To get the Michigan Transportation Partnership activities underway and to ensure a sustainable commitment among the partners to a joint effort that provides value to both the state and the companies, the following activities will be pursued:

¹ Each activity is followed by a reference to the activity measures (see page 30 for Measures of Success) in parentheses and the year the activity will be started, i.e., 07 for 2007 and 08+ for 2008 and the following years.

² The letter and the number in parentheses in the strategy section titles will assist with referencing the activities listed in Figure 1. MDOT Line-of-Business for VII diagram. Groups of activities support each goal in the MDOT Line-of-Business for VII.

1. Form Michigan Transportation Partnership (MTP) with automotive OEMs. (1, 2) 06
2. Hold an annual workshop and summit at the Management Briefing Seminar (MBS) (1, 2, 3) 06+
3. Hold semi-annual meetings of the MTP (1, 2, 3) 06+
4. Review MDOT VII program and projects annually (4) 07+
5. Review and update MDOT's VII strategic plan (4) 06+
6. Coordinate state, regional, and national deployment strategies with automotive companies and national deployment plans. (See B2) (1, 4) 07+
7. Expert survey and forecast integrated systems and technologies to help target partnership needs and opportunities (1, 4) 06+
8. Survey best practices and formulate new VII business models that support innovation and partnership opportunities (1, 4) 07+

Michigan VII Working Group (A2 in Figure 1)

MDOT will establish a VII working group that will hold regular working meetings with automotive suppliers, telecommunications, and consumer electronic companies.

1. Establish a Michigan VII Working Group to meet periodically to share information, coordinate activities, and monitor progress on test bed, proof of concept, Connected Vehicle Proving Center, field operational test, and Michigan deployment planning activities. (1, 2) 06
2. Enable representation from the VII Working Group in the MTP meetings with OEMs and coordinate meetings to provide timely input and feedback to the OEM partnership. (1, 2, 4) 06+
3. Develop plans for Proof of Concept (POC), Field Operational Test (FOT), Proving Center, and allied Michigan Test Bed activities with automotive OEMs, automotive suppliers, telecommunications, and consumer electronics company input. [See C#2, #6, #7] (1, 4) 06+
4. Coordinate and monitor VII Working Group task assignments and progress. (4) 06+
5. Work with the VII-C to select Proof of Concept tasks and coordinate these tasks with the Michigan Test Bed planning and deployment. [See C] (1, 2, 4) 06+

6. Develop work plans for the Michigan Test Bed that complement the VII-C and other stakeholder initiatives and enable the Test Bed to incorporate the VII-C findings. [See C#5, #6] (4, 5) 07+
7. Assist the MTP with developing a state and regional deployment plan based on the national VII deployment plan. (See B2) (1, 2, 4, 5) 07+
8. Hold internal meetings with MDOT staff to stay abreast of progress and recent developments. (1, 2, 3, 4, 30, 31) 06+

Inter-State Partnership (A3 in Figure 1)

MDOT will establish partnerships with lead VII states in coordination with conference opportunities to share progress and create opportunities for coordinated research and eventually cross-state deployment expansion.

1. Correspond with other states expanding their VII development including extending invitations for other states to participate in the Michigan program. (1, 2, 4) 06+
2. Maintain a leadership role on AASHTO's VII committees. (2) 06+
3. Maintain a leadership role on the VII National Leadership Committee. (2) 06+
4. Continue with Michigan's participation and involvement in the USDOT's VII National Working group. (2) 06+
5. Escalate Michigan's involvement in the SmartHighway program that includes Florida, California, Minnesota, and other possible states. (1, 2, 3, 4) 06+
6. Expand Michigan's involvement in regional corridor programs including the Transportation Operations Partnership (TOP) Forum and the Gary-Chicago-Milwaukee (GCM) with the intent of regional VII deployment expansion. (2) 06+

Infostructure Deployment Strategy (B in Figure 1)

With the completion of the interstate highway system, increasing congestion, and growing limits to highway expansion has become more important for MDOT to improve the operations of the road transportation systems to make the most of investments in transportation infrastructure assets. The VII infostructure strategic goal is to lead the nation in the designing, testing, and deployment of an effective standard VII infostructure.

MDOT has been working with the automotive, telecommunications and consumer electronics companies to collectively design, test, and deploy a wireless infrastructure on Michigan roads. This investment will enable vehicles to communicate with the roadside and exchange messages

in real time to improve vehicle safety and to provide transportation services inside the vehicle and to our traffic management centers.

MDOT's efforts in this area are at a critical turning point. The USDOT plans to develop and test this new technology to prove the concept, and to demonstrate the potential benefits of a national deployment scheduled for 2008. Federal support will advance Michigan's position toward this objective. However, even without external support Michigan intends to move forward through local investment and partnerships.

The following activities will assure that MDOT leads the nation in design, testing and deploying an effect standard VII national infostructure:

1. Contribute to the deployment discussions of the national VII Working Group and Leadership Committee [See A3 #3, #4] (2) 07+
2. Prepare a State of Michigan VII Deployment plan that coordinates Michigan's deployment with national expansion. [See A1 #6 and A2 #7] (1, 4, 5) 07
3. Leverage the Michigan and Midwest field operational test with plans for national deployment. Include Midwest regional deployment in the Michigan VII Deployment Plan. (1, 4, 5) 07
4. Deploy VII infostructure according to plans and in coordination with the VII-C POC and FOT, USDOT national deployment plan, and standards committees. (1, 7, 16, 23) 09+

Test Bed Strategy (*C in Figure 1*)

The test bed strategy will focus mostly on process in the short run and safety and mobility objectives in the long run. While it is unlikely that the system design and testing phases of the VII program will have much (if any) impact on mobility and safety, it will be through proof of the concept, proving center developments, and operational testing and evaluation that VII will reach readiness for deployment of a public infrastructure and the sale of new mobile products and services. Therefore, involvement with and successful completion of proof of concept, field testing, the system evaluation processes and activities will provide the measure for the goals of safety and mobility. MDOT's goal is to design, implement, maintain, and promote Michigan VII test and development facilities.

MDOT will initiate and implement Michigan's VII Test Bed to deploy sustainable VII infrastructure, support the VII-C's POC projects, and create an environment for FOTs and eventual sustained deployment of VII in Michigan and across the nation. The design and deployment of a self-supporting infrastructure will provide value without respect to the success of VII and will provide continued value even if the VII decision is no-go in 2008. MDOT will pursue the following activities to implement-the test bed goal:

1. Design a self-supporting test bed infrastructure, including data collection server and analysis tools, which will provide continued value even if the VII decision is no-go in 2008. See specific use cases (DEF) for details. (4, 5, 6, 16, 23) 06+
2. Prepare test bed plan with the partners. [A2 #3] (1, 2, 5, 17) 06+
3. Deploy test bed infrastructure as planned. (5, 6, 7, 8, 9, 16) 06+
4. Evaluate the technical and functional operation of the test bed infrastructure including data communication, signal availability, and networking. [See A2 #1] (5, 6, 7, 8, 9, 16) 07
5. Evaluate the benefits and costs of asset management, traffic management, safety, and other use cases, taking advantage of the OEM leased vehicles, and assessing the impact on MDOT and other public and private organizations. [See D, E, and F for more details.] (9, 10, 11, 14) 07
6. Work with the automotive companies and the VII-C to design successful POC projects and “Field Trials” that will eventually integrate into test bed and later support Michigan’s state and national VII deployment plan. [A2#5, #6] (1, 2, 5, 7, 16) 06+
7. Design the test bed to coordinate with the Connected Vehicle Proving Center, Cooperative Intersection Collision Avoidance Systems, IVBSS, and other projects supported by Crash Avoidance Metrics Partnership (CAMP), University of Michigan Transportation Research Institute and other state research organization like Michigan State University and University of Detroit Mercy. [A2#6] (1, 5) 06+
8. Operate, manage, staff, and maintain test bed and make it available for use with continuous operation and functionality. (7, 9, 11, 15) 06+
9. Provide training and support for use of the test bed. (11) 07+

Safety Strategy (*D in Figure 1*)

Safety is the primary goal that is shared by automotive companies and transportation agencies. There were 1,159 persons killed and 99,680 persons injured in 373,028 reported motor vehicle traffic crashes in Michigan during 2004. The safety objectives will not advance significantly until there is significant deployment of the telecommunications infrastructure and until drivers purchase vehicles that support the consumer electronics that complete the safety and mobility applications. Nevertheless, VII presents an opportunity to save hundreds of Michigan lives and to prevent even more injuries, property damage and related productivity loss through improvements such as:

- Prevent crashes and reduce their severity at intersections by providing traffic monitoring, detecting dangerous situations, warning drivers, and possibly even controlling signals and vehicle behavior.
- Warn drivers to reduce speeds at curves and work zones as well as dangerous and unintended lane departures
- Increase driver awareness by providing warnings for: school zones, hazardous road conditions, low overhead (i.e., bridge, parking garage, storage), wrong way, and other potentially dangerous road features.

Crash prevention and reduction in severity will be essential measures for evaluating the potential benefit of VII use cases that will be designed, tested, and deployed in Michigan. While there will be little actual improvement in safety during the system design and test phases, the candidate user applications will nevertheless be studied and evaluated for their potential future contribution to improved driver safety. MDOT's goal is to advance Michigan-based VII safety system research, development, and early deployment to reduce accidents and delay while increasing the safety of equipped vehicles.

The other high priority category of use cases is safety warning systems. In-vehicle warning systems are primarily designed to increase motorist safety by providing in-vehicle warnings at selected road features like dangerous curves and intersections. These generally involve short-range vehicle-to-infrastructure and infrastructure-to-vehicle communication to inform the roadside of vehicle behaviors and to warn drivers of impending conditions.

One of the real opportunities provided by VII to road transportation agencies is increasing the protection for drivers and workers around work zones. Work zone notifications related to driver warnings are high priority applications for MDOT. MDOT has continuing interest in most in-vehicle signage systems including road advisories and local notifications. The specific activities to support this goal are listed below:

1. Research and develop use cases, possibly participating in pooled fund study with other states, in the following areas:
 - Active collision avoidance (17, 18, 19, 26) 08+
 - Passive hazard warnings (17, 18, 19, 26) 08+
 - In-vehicle signing (17, 18, 19, 26) 07+
 - Work and school zone notification (17, 18, 19, 26) 07+
 - Identify roadway design deficiencies (17, 18, 19, 22, 26) 09
2. Plan, design, and validate roadside equipment and back-office applications that will support these use cases. [See C1 and B4] (7, 8, 16, 23) 07+

Traffic Management Strategy (*E in Figure 1*)

The goal is to advance Michigan-based VII traffic management system research, development, and early deployment to improve the mobility of Michigan drivers and their access to information about destinations and travel choices. This includes increasing traffic efficiency to help drivers save time and money by providing alternate routes in response to traffic incidents. VII will provide probe data and infrastructure management tools for both operators and users of the transportation system. The probe data will assure comprehensive coverage by including all roads, jurisdictions, and (eventually) all vehicles. It will increase mobility, accessibility and traffic efficiency by making improvements such as:

- Inform drivers and re-route traffic around construction, work zones, accidents, or planned special events, using information from the vehicle probe data.
- Increase throughput by smoothing the flow of traffic through signals using vehicle probe data to re-time signals and/or control signals dynamically through real time traffic counts.
- Relieve congestion by detecting vehicles to improve the responsiveness of traffic signals and ramp metering.
- Improve transportation modeling, forecasting, and planning by obtaining more detailed data from probe vehicles.
- Sharing vehicle probe data regarding roadway hazards (such as cracks and potholes, road weather problems, or even sight distance and design problems) with traffic operations centers and traffic planning departments.
- Improve the management of road transportation assets by monitoring the network for pavement, bridge and other infrastructure conditions including assistance with sign inventories.

Probe applications are one of the highest priority categories of user services for MDOT because construction, maintenance, and operation of the state highways and surface streets are MDOT's primary lines of business. Data collected from vehicle probes will help MDOT plan for future road usage and possible expansion of facilities. It can be used to assess the appropriateness of investment in construction and maintenance, monitor maintenance needs like snow and ice removal and crack and pothole mapping. One of MDOT's chief objectives is to assess traffic patterns including origins, destinations, travel routes, traffic volumes, etc. to help plan for and maintain the road network.

Two-way in-vehicle communication systems are also of great value to MDOT because they provide a way to communicate information to drivers with little infrastructure investment to help relieve traffic congestion. These systems can help provide motorists information on incident, special event, & work zone alerts and bottleneck/congestion mapping. Because probes help detect traffic blockages, they assist with dynamic route guidance and navigation based on real time traffic information. Since the following use cases are addressed by the USDOT's "day one" plan for VII testing and deployment, the specific cases will be pursued in cooperation with other

states involved in the USDOT's national testing and deployment activities. The specific activities to support this goal are listed below:

1. Research and develop use cases, possibly participating in pooled fund study with other states, in the following areas:

Traveler Information Dissemination:

- En route accident/construction/event alerts (17, 20, 21, 26) 07+
- Real-time detour/reroute information (17, 20, 21, 26) 08+
- Tourism/commerce information (17, 24, 26) 07+
- Real-time multi-modal transfer information (10, 21, 26) 08+

Relieve Congestion:

- Traffic signal actuation and operations (17, 19, 20, 21, 26) 09+
- Work zones (17, 19, 20, 21, 26) 07+
- Ramp metering (17, 20, 21, 19, 26) 09+
- Improved traffic performance measurement and management (14, 17, 26) 07+

2. Plan, design, validate, and deploy (or acquire) roadside equipment and back-office applications that will support these use cases. [See C1 and B4] (7, 8, 16, 23) 07+

Asset Management Strategy (*F in Figure 1*)

The goal is to advance Michigan-based VII asset management system research, development, and early deployment. The probe applications offer access to data sources that will help MDOT assess and model transportation demand and traffic flows. Other VII data will help document pavement, bridge, and other infrastructure conditions, helping to reduce the cost of delivering these services. The plan for asset management is to collect data to determine if the service life of an existing asset has failed to meet the expected design life, achieved the expected design life, or exceeded it, and why. Another objective is to determine which assets have the biggest impact on the community. The specific activities to support this goal are listed below:

1. Research and develop use cases, possibly participating in a pooled fund study with other states, in the following areas:

Asset Management:

- Pavement (14, 25, 26) 08+
- Bridge (14, 25, 26) 08+
- Sign Inventories (14, 25, 26) 07+

Transportation Planning:

- Origin/Destination data (14, 25, 26) 08+
- Modeling (14, 25, 26) 09+
- Forecasting (14, 25, 26) 09+

Maintenance Programs:

- Snow/ice removal (14, 25, 26) 09+
- Pavement joint/crack and pot hole mapping dissemination (14, 25, 26) 08+
- Bridge deck monitoring (14, 26) 09+

2. Plan, design, validate, and deploy (or acquire) roadside equipment and back-office applications that will support these use cases. [See C1 and B4] (7, 8, 16, 23) 07+

Outreach Strategy (*G in Figure 1*)

MDOT will establish and support a public outreach program. The goal is to maintain high visibility of Michigan activities through outreach and public awareness. This activity will maintain MDOT's connection to other interest groups and to inform the public of the progress. The specific activities to support this goal are listed below:

1. Coordinate with Wireless Oakland and Washtenaw counties to address the interjurisdictional issues for managing roadside Dedicated Short Range Communication (commonly referred as DSRC) radios, Wi-Fi, WiMax, and mesh network deployment between sources and across jurisdictions. (1, 2, 13) 06+
2. Work with the Southeast Michigan Council of Governments (commonly referred as SEMCOG) to assure that VII is incorporated into the Michigan ITS Architecture and that the regional traffic operations organization takes VII cross-jurisdictional issues into account. (1, 2, 4, 7, 13) 07+
3. Plan presentations and report progress at ITS America, ITS Michigan, ITS World Congress, the Transportation Research Board (TRB), AASHTO, the Society of Automotive Engineers, Telematics Detroit, Management Briefing Seminar, and other conference and national outreach events. (1, 2, 4, 12, 13) 06+
4. Get Michigan staff in leadership roles on ITS America, TRB, and AASHTO committees. (1, 2, 27) 06+
5. Develop VII web site and a Michigan VII Newsletter that will be distributed monthly by mail. (4, 9, 10, 11, 24, 28) 06+

6. Establish working relationships with the Connected Vehicle Proving Center, Michigan universities, AASHTO, CVTA, ITS America (i.e., VII Task Force and Automotive Telecommunications & Consumer Electronics Forum), Center for Automotive Research, and ITS Michigan for ongoing discussions with stakeholders. (1, 29) 06+
7. Document and publish lessons learned to improve the state-of-the-art and practice in VII wireless communication. (4, 5, 11, 28) 07+
8. Develop and maintain a central repository of information on VII activities in State of Michigan. (11, 10, 24) 08+
9. Develop and maintain relationships with international transportation agencies. (1, 2) 06+

Justification Strategy (*H in Figure 1*)

VII will only be a success if MDOT can justify the start-up effort and sustained investment. The goal is to justify a planned deployment through analysis and research providing evidence of value-added results. Justification will rest on the industrial and economic development potential as well as the direct projected costs and benefits associated with an advantageous return on the investment of tax dollars. Therefore, it will be essential for MDOT to investigate the impacts of VII and engage the public in a dialogue based on sound facts and informed projections of the impacts. The specific activities to support this goal are listed below:

1. Prepare a study on the industrial and economic development potential for VII in Michigan to assure positive consequences of VII testing and deployment. (4, 5, 11) 06+
2. Investigate the potential for creating and/or attracting federal automotive safety facilities to Michigan. (4, 5, 11) 06+
3. Conduct a study of the projected benefits, cost and return on investment of VII for the State of Michigan and other partners. (1, 4, 11) 07+

Investment Strategy (*I in Figure 1*)

Successful investment in new technologies, programs, projects, hardware, software, infrastructure, and infostructure is essential to starting and sustaining VII. Therefore another goal for MDOT is to coordinate and leverage the Michigan investment and attracting federal and international support.

In addition to the pursuit of safety, mobility, sustainability, partnership, and economic development strategies that will define MDOT's effectiveness with regard to improving transportation and exercising a role in national leadership, MDOT also needs to address internal issues that will regulate the effectiveness toward this pursuit. Internal issues include the

alignment of MDOT's transportation mission and the VII strategy to the mission of other agencies with responsibilities for economic development and information technologies within the State of Michigan. The specific activities to support this goal are listed below:

1. Program VII into the annual budgeting of Michigan's transportation needs. Enter VII as a line-item in the State Transportation Improvement Plan and ensure that sufficient match monies are available. (1, 7, 25, 30) 07+
2. Investigate other sources of private sector and federal funding like Homeland Security, USDOT, etc. (1, 2, 7, 30) 06+
3. Coordinate with MEDC, the Michigan Department of Labor & Economic Growth, DIT, and MSP to seek grants for VII testing and deployment. (1, 2, 7, 25, 30) 06+
4. Invest in VII staffing to ensure that activities from the strategic plan are coordinated and completed. (1, 7, 23, 30, 31) 06+

Measures of Success

The following measures are referenced by number following each of the activities listed in the VII strategy.

1. Get the right people involved
2. Did the right people meet?
3. Did the meeting have value and useful results?
4. Documented and completed
5. Technical value and merit*
6. Self supporting
7. Compliance with plans and timeline
8. Functional testing and validation*
9. Reliability (i.e., hardware, software)*
10. Ease of use in the human factors sense
11. Available to users
12. Participation/attendance
13. Make presentation
14. Benefits, costs, return-on-investment
15. Operational continuity
16. Compliance with technical standards (Identify standards to be met.)
17. Use OEM leased vehicles (number of vehicles in use)
18. Significant change in desired outcome (i.e., scientific comparison with before/after, and control groups)
19. Reduced number of traffic accidents and traffic-related injuries and fatalities by location and type
20. Total delay
21. Average travel time
22. Road quality (surface, structure, geometry)*
23. Within budget
24. Customer satisfaction (i.e., survey)
25. Community/public support (i.e., survey)
26. Data accuracy, reliability, and comprehensiveness*
27. Assigned to leadership role
28. Up-to-date and current content
29. Program involvement
30. Internal MDOT support
31. Work completion, staffing, capacity, resource coverage and use

*Measures with asterisks need further elaboration.

Glossary of Terms

American Association of State Highway and Transportation Officials (AASHTO) - A nonprofit, nonpartisan association representing highway and transportation departments in the 50 states, the District of Columbia and Puerto Rico. The American Association of State Highway and Transportation Officials advocates transportation-related policies and provides technical services to support states in their efforts to efficiently and safely move people and goods.

Active Safety Systems - Active safety refers to everything designed to help prevent an accident from happening, such as, anti-lock braking system (ABS) and the traction control (ASR) to name a few.

Asset Management – Transportation asset management is a strategic approach to managing physical transportation infrastructure. Asset management promotes more effective resource allocation and utilization based upon quality information.

Crash Avoidance Metrics Partnership (CAMP) – A research partnership between Ford and GM that creates research consortia with other car manufacturers and their first-tier suppliers for crash avoidance research projects.

Center for Automotive Research (CAR) - Conducts industry research, develops new methodologies, forecasts industry trends, advises on public policy, and sponsors multi-stakeholder communication forums.

Cooperative Intersection Collision Avoidance Systems (CICAS) – Safety systems that have the potential to warn drivers about likely violations of traffic control devices and to help them maneuver through cross traffic safely.

Connected Vehicle Proving Center (CVPC) - A new proving center that supports the testing and evaluation of new products and services dedicated to improving vehicle safety and creating a pipeline for real-time broadband communication between vehicles, roadside transceivers, and remote service centers.

Connected Vehicle Trade Association (CVTA) - An association that enables the collaboration of companies, organizations, and governmental bodies engaged in developing vehicle communications.

Department of Transportation (DOT) - An organization responsible for transportation services in a political jurisdiction such as a State or city.

Dedicated Short Range Communications (DSRC) - A wireless (radio) communications approach that enables short range communications between vehicles and between vehicles and the roadside for a variety of purposes.

Field Operational Test (FOT) – An operational testing and evaluation activity where test subjects use products and systems in field trials under conditions of conventional use.

Global Positioning System Global Positioning System (GPS) – A worldwide radio-navigation system formed from a constellation of 24 satellites and their ground stations.

Infostructure – The intellectual content, facilities, information services, and technical systems provided in support of transportation communications by information resources and information technology.

In-Vehicle Based Safety Systems (IVBSS) - A USDOT program to develop and test systems that warn drivers when they may be about to leave the roadway, are in danger of colliding with another vehicle while attempting a lane change, or are at risk of colliding with the vehicle in front of them.

Line-of-Business – A logical way to conceptualize, develop and implement sustainable strategies at the line-of-business level.

Management Briefing Seminar (MBS) – An automotive industry conference in Traverse City every August. The 2007 Management Briefing Seminars will again take place at the Grand Traverse Resort and Spa Traverse City, Michigan, USA and the dates are August 6-10, 2007.

Michigan Transportation Partnership (MTP) – A strategic alliance between the State of Michigan and the automakers that will focus on technology-based innovation and support for new OEM business models that bring advanced auto technologies into the marketplace more cost effectively and expeditiously.

Original Equipment Manufacturer (OEM) - a term used to describe those companies that are the original manufacturers of vehicles and equipment.

Passive Safety Systems - Passive safety is a general term covering all design measures intended to protect the car's occupants against injury or to at least reduce the severity of injuries (examples include safety belts and airbags).

Proof of Concept (POC) – Product development activity that proves the viability and integrity of the engineering concept.

State Transportation Improvement Program (STIP) - A three-year program of all road and transit transportation projects to be undertaken with federal funds, required by ISTEA to be financially constrained, meet air quality conformity guidelines, and be consistent with the policies of the State Long Range Plan.

Testbed – A system representation consisting of vehicles, devices, and systems including actual hardware and/or software and computer models or prototype hardware and/or software for testing and evaluating a complete systems or components of a system.

Transceiver – A transmitter-receiver transmits and receives signals.

University of Michigan Transportation Research Institute (UMTRI) - A research institute at the University of Michigan that conducts interdisciplinary transportation-related research that will ultimately increase driving safety and further transportation-systems knowledge.

United States Department of Transportation (USDOT) - A Cabinet-level Department that exists to serve the United States by ensuring a fast, safe, efficient, accessible, and convenient transportation system that meets our vital national interests and enhances the quality of life of the American people, today and into the future.

Use Cases – A use case is a description of a system that captures a goal-oriented set of interactions between external actors and the system under consideration.

Vehicle Infrastructure Integration (VII) - The application of wireless communication technologies to support mobile connectivity between vehicles and between vehicles and the roadside infrastructure.

Vehicle Infrastructure Integration Consortium (VII-C) - A Michigan nonprofit corporation founded in 2005 by group of light-duty vehicle manufacturers to design, test, and evaluate a deployable VII system for the United States.